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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/699,284	10/31/2003	Daniel C. Worledge	YOR920030410US1	2560
7590 07/12/2005			EXAMINER	
Ryan, Mason & Lewis, LLP Suite 205 1300 Post Road Fairfield, CT 06824			NGUYEN, THINH T	
			ART UNIT	PAPER NUMBER
			2818	

DATE MAILED: 07/12/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/699,284

Applicant(s)

WORLEDGE, DANIEL C.

Examiner

Thinh T. Nguyen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 October 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-25 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-12, 15-17 and 20-25 is/are rejected.
- 7) ☒ Claim(s) 1, 13, 14, 18 and 19, 22, 25 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 31 October 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED OFFICE ACTION

Specification

1. The Specification is objected to for many ambiguities in the specification making the disclosure incomplete.

A/ Applicant claims that the invention is based on the single domain theory, however, the disclosure is totally silent on this theory.

Are all known ferromagnetic materials qualify to be a single domain magnetic material or they have to possess certain attributes also does the external field have to meet some constraints or they can be single domain and multi-domain?

B/ Applicant fails to show that when the two magnetic layers are non-elliptic how do you find out the shape factor ?

C/ Applicant claims that the method and the embodiment of Applicant 's invention Comprises ferromagnetic coupling that required $J > 0$ and when there are no external fields the coupling will be antiferromagnetic that required $J < 0$ but in fig 2 the spin flop cycle lie entirely in the domain wherein $J < 0$ that means the predominant coupling is antiferromagnetic.

Clarifications are required.

2. The specification has been checked to the extent necessary to determine the presence of all possible minor errors. However, the applicant cooperation is requested in correcting any errors of which the applicant may become aware in the specification.

Drawings

3. The Drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the drawing of a semiconductor device wherein the magnetic layers have a ferromagnetic coupling and have antiferromagnetic net coupling at zero field (in claim 1) must be shown or the features cancelled from the claim(s). No new matter should be entered.

A proposed drawing correction or corrected drawings are required in the reply to the Office Action to avoid abandonment of the Application. The objection to the drawings will not be held in abeyance.

Claims Objections

4. Claims 1 and 22,25 are objected to failing to enable the invention make them non-compliance with 35 U.S.C. 112 first paragraph. There are not enough details for a person skill in the art to make use of the invention since there is not enough details to construct the embodiment of claim 1 or to apply the method of claim 22 that require the semiconductor to have ferromagnetic coupling ($J > 0$) according to the applicant and yet have a net coupling at zero field ($J < 0$).

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of U.S.C. 112:

the specification shall conclude with one or more claims particularly point out and distinctly claiming the subject matter which the applicant regard as the invention.

6. Claims 1 and 22,25 are rejected under 35 U.S.C. second paragraph as being indefinite since net coupling antiferromagnetic at zero field and ferromagnetic exchange coupling depend on the thickness of the three layers , the shapes of the three layers, the material characteristics of the three layers, the external field (10 different parameters) and not enough of the limitations to these parameter are recited in claims so it is impossible to find the meters and bound of the structure or method that the applicant wants to have patent protection .

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102(a/b/e) that form the basis for the rejections under this section made in this office action.

A person shall be entitled to a patent unless --

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claim Rejections - 35 USC § 103

8. The following is a quotation of U.S.C. 103(a) which form the basis for all obviousness rejections set forth in this office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. To expedite the prosecution of the case, the Examiner assumes the Applicant will correct the specifications and amend claims 1,22,23 to overcome the objections and rejections under 35 U.S.C. 112 and will examine those claims as best as it can be understood by the Examiner.

10. Claim 1-4, 9, 11-12,15,17,22-24 are rejected under 35 U.S.C. 102(b) as being anticipated by Zhu et al. (U.S. Patent 5,768,183) or as an alternative being obvious over Zhu et al. (US patent 5,768,183).

REGARDING CLAIM 1

Zhu discloses (in the abstract, in fig 1) a semiconductor device comprising: at least two magnetic layers; and a spacer layer formed between the magnetic layers, the spacer layer being configured to provide ferromagnetic exchange coupling between the layers, the magnetic layers experiencing anti-ferromagnetic dipole coupling, such that a net coupling of the magnetic layers is anti-ferromagnetic in a zero applied magnetic field.

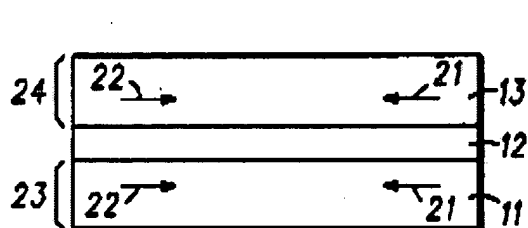


FIG. 1
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REGARDING CLAIM 2

Zhu discloses (the title) a MRAM device

REGARDING CLAIM 3

This is an inherent characteristics of the device disclosed by Zhu of two magnetic layers that are anti-ferromagnetically coupled separated by a spacer that provided exchange coupling.

REGARDING CLAIM 4

Zhu discloses (fig 1) two layers (column 4 lines 21-22) wherein the thickness of the first layer is from 3 to 6 nanometers and the thickness of the second layer is from 4 to 10 nanometers, therefore they have the same thickness when they are in the range of 4 to 6 nanometers.

REGARDING CLAIM 9

Zhu discloses (column 3 line 9) the uses of Ni Fe

REGARDING CLAIM 11,12,23,24

Zhu discloses (column 3 line 57) the use of Copper (Cu) and Chromium (Cr) transition Metal..

REGARDING CLAIM 15

Zhu discloses (column 3 line 58) the use of insulator

REGARDING CLAIM 17

Zhu discloses the use of Copper Spacer and its oxide that are non-magnetic.

REGARDING CLAIM 22

Zhu discloses (in the abstract, in fig 1) a method for coupling magnetic layers in a semiconductor device comprising at least two magnetic layers and a spacer layer therebetween, the method comprising the step of providing ferromagnetic exchange coupling of the magnetic

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layers, the magnetic layers experiencing anti-ferromagnetic dipole coupling, such that a net coupling of the magnetic layers is anti-ferromagnetic in a zero applied magnetic field.

Claim Rejections - 35 USC § 103

11. The following is a quotation of U.S.C. 103(a) which form the basis for all obviousness rejections set forth in this office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

12. Claims 5, 6,7,10,16,20-21, 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhu et al. (U.S. patent 5,768,183) in view of further remark.

REGARDING CLAIM 5

Zhu discloses all the invention except for the specific relative thickness of the two magnetic layers. This feature, however, is considered obvious since it has been held that when the general conditions of a claim are disclosed in the prior art discovering the optimum or workable range is of ordinary skill in the art.

REGARDING CLAIM 6,7

Zhu discloses all the invention except for the uses of an elliptical or circular shapes; these features, however, are considered obvious since the use of elliptical or circular shape are old and well known in the art as evidenced by the disclosure by Deak (US patent 6,728,132) fig 2b.

A person skill in the art at the time the invention was made would be able to use the disclosures by Zhu and come up with the invention of claims 6,7 without special teachings.

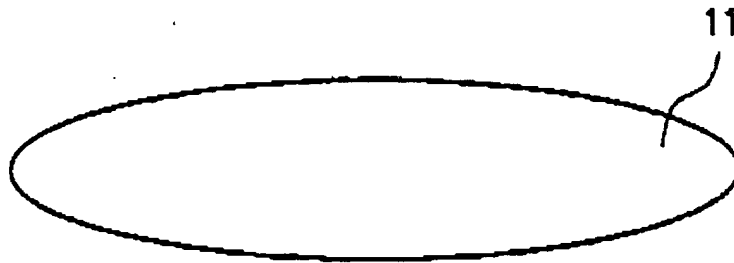


FIG. 2b

REGARDING CLAIM 10

Zhu discloses all the invention except for the use of $\text{Ni}_{80}\text{Fe}_{20}$. This feature, however, is old and well known in the art as evidenced by the disclosure by Wadley et al. (US patent 6,478,931) column 2 line 50.

The reason why claim 10 is obvious over Zhu has been discussed in the rejection of claim 6,7.

REGARDING CLAIM 16

Zhu discloses all the invention except the use of Al_2O_3 in the spacer layer; however, the use of Al_2O_3 as spacer layer is old and well known in the art of making MRAM.

The reason why claim 16 is obvious over Zhu has been discussed in the rejection of claim 6,7.

REGARDING CLAIM 20,21

Zhu discloses all the invention except for going into detail about the specific thickness of the spacer layer. These features, however, are considered obvious since it has been held that where the general condition of a claim arte disclosed in the prior art, discovering the optimum value or workable range involves only routine skill in the art.

REGARDING CLAIM 25

Zhu discloses all the invention except for the changing the thickness to attain a specific configuration. This feature, however, is considered obvious since it has been held that where the general condition of a claim arte disclosed in the prior art, discovering the optimum value or workable range involves only routine skill in the art since the feature of claim 25 only amount to a mere change of size.

13. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Zhu et al. (U.S. patent 5,768,183) in view of Savtchenko et al. (US patent 6,545,906) provided in Applicant 's IDS.

REGARDING CLAIM 8

Zhu discloses all the invention except for the uses of two layers with the same intrinsic anisotropy. Savtchenko, however, discloses (in column 7 lines 25-34) discloses two coupled Magnetic layers that has the same intrinsic anisotropy.

It would have been obvious to one of ordinary skill in the art the time the invention was made to combine the teachings by Zhu with the teachings by Savtchenko in order to come up with the invention of claim 1 since a person skilled in the art would have been motivated to

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improve the writing characteristics of the Zhu device as suggested by Savtchenko (column 2 lines 6-10).

ALLOWABLE SUBJECT MATTER

14. Claims 13, 14, 18, 19 are objected as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all the limitations of the base claim and any intervening claim.

Claim 13, 14, 18, 19 are considered allowable since the prior fails to teach all the additional technical features as recited in these claims.

15. When responding to the office action, Applicants are advised to provide the examiner with the line numbers and the page numbers in the application and/or references cited to assist the examiner to locate the appropriate paragraphs.

16. A shortened statutory period for response to this action is set to expire 3 (three) months and 0 (zero) day from the day of this letter. Failure to respond within the period for response will cause the application to be abandoned (see M.P.E.P. 710.02(b)).

CONCLUSION

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17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thinh T Nguyen whose telephone number is 571-272-1790.

The examiner can normally be reached on Monday-Friday 9:00am-6:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Nelms can be reached at 571-272-1787.

The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval [PAIR] system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Thinh T. Nguyen *TTN*

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David Nelms
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Technology Center 2800